Report of the Biological Survey of Mutsu Bay_11. Starfishes of Mutsu Bay.

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11. Starfishes of Mutsu Bay.*

By

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(With Plates XXXI–XXXIII)

The present paper is mainly based on specimens of starfishes collected in connection with the biological survey of Mutsu Bay carried out by the Tôhoku Imperial University in 1926–1927, but those collected by Mr. B. Hikita, and some in Prof. S. Goto's hands and in the Imperial Fishery Institute were used for comparison. Observations on living animals were made during my short sojourns at Asamushi Marine Biological Station in the summer of 1925, 1926 and 1927. The collection includes 3 species of Phanerozonia, 4 species and 3 varieties of Spinulosa, and 4 species of Forcipulosa, 11 species and 3 varieties in all, with one new species and one new variety.

Order PHANEROZONIA.

Family Astropectinidae.

1) *Astropecten scoparius* Valenciennes.

Family Luidiidae.

2) *Luidia quinaria* von Martens.
3) *Luidia yesoensis* Goto.

Order SPINULOSA.

Family Asterinidae.

4) *Patiria pectinifera* (Müller & Troschel).

*A contribution from the Marine Biological Station, Asamushi, Aomori-Ken.

Family Echinasteridae.

5) *Henricia sanguinolenta* (MÜLLER).
6) *Henricia leviuscula* (STIMPSON).
7) *Henricia leviuscula* var. *inequalis* (VERRILL).
8) *Henricia leviuscula* var. *multispina* FISHER.
9) *Henricia leviuscula* var. *nipponica* n. var.

Family Solasteridae.

10) *Solaster dawsoni* VERRILL.

Order FORCIPULOSA.

Family Asteriidae.

11) *Asterias rollestoni* SLADEN.
12) *Asterias nipon* DÖDERLEIN.
13) *Aphelasterias japonica* (BELL).

Family Pedicellasteridae.

14) *Labidiaster borealis*, n. sp.

The most common starfish in the Bay is *Asterias rollestoni* with purple abactinal surface and easily collected in large numbers by the "ebiami"-dredge among sea-weeds, and the next common is *Patiria pectinifera* occurring on rocks near the tidal line. *Henricia leviuscula* var. *nipponica*, a small carmine coloured species, is also common between rocks and in their crevices. *Astropecten scoparius*, *Luidia quinaria* and *Luidia yesoensis* are found on sandy or muddy flats. The three comparatively large species, *Solaster dawsoni*, *Asterias nipon* and *Labidiaster borealis*, as well as *Aphelasterias japonica* occur in relatively deeper parts of the Bay.

From the viewpoint of distribution, the starfish fauna of the Bay is mainly arctic but includes some widely distributed temperate forms, such as *Astropecten scoparius*, *Luidia quinaria*, *Patiria pectinifera* and *Asterias rollestoni*. The most interesting fact is the occurrence of a

species of *Labidiaster*, a genus hitherto known only from the southern hemisphere.

Before proceeding further, I should like to express here my warm thanks to Prof. S. HATAI, Prof. S. HÔZAWA, Assist. Prof. S. KOKUBO, Mr. S. TAKATSUKI and Mr. KAMADA for collecting materials and for several kindnesses shown during my sojourns at Asamushi Marine Biological Station. My thanks are also due to Prof. B. HIKITA, of the Hokkaido Imperial University, for Oshoro specimens, to Prof. H. Ohshima, of the Kyushu Imperial University, for several advices received in the course of the work, and especially to Prof. S. GOTO under whose guidance the paper has been brought to the present form.

Order PHANEROZONIA.

Family **Astropectinidae.**

1) **Astropecten scoparius** VALENCIENNES.

Astropecten scoparius: MÜLLER & TROSCHEL, 1842, p. 71. — GOTO, 1914, p. 119, pl. 3, fig. 34–41.

It is common on sandy or muddy bottoms of the Bay. A detailed description being given by GOTO (1914), there is no need to repeat it here. Young specimens collected on deeper muddy bottoms were bluish gray and had a central conical protuberance on the abactinal surface; but well developed ones from shallow sandy bottoms were brown in colour, which was especially pronounced in the central portion of the abactinal surface and bases of the rays, and their abactinal disc was almost flat but when kept in the aquarium the central part showed a conspicuous conical protuberance. Regenerated rays show the colour of young specimens.

Japanese name: Momijigai.[1]

Loc. Off Okunai, Aug. 7, 1923, 3 specimens; off Yukawa, Aug. 7, 1926, 1 specimen; off Hinoki, Aug. 23, 1926, 1 specimen; off Tomarikawa, Aug. 22, 1926, 2 specimens; off Namiuchi Park, July 25, 1926, 14 specimens. Many other specimens from near the Biological Station. The species is very common on sandy flats from

[1] momiji = maple; gai = shell.

Kyushu to Hokkaido. Goto (1914) recorded the occurrence of the starfish in the Bay.

Family **Luidiidae.**

2) **Luidia quinaria** von Martens.

Luidia quinaria : Goto, 1914, p. 293, pl. 7, fig. 104–112.
Luidia quinaria var. *quinaria :* von Martens, 1865, p. 352.

According to Goto (1914), the starfish is common on the southern coasts of Honshu, Shikoku and Kyushu but comparatively rare in Hokkaido. In the Bay it is less common than the other two phanerozoids.

Japanese name : Suna-hitodé[1]

Loc. Off Ōminato, Aug. 11, 1926, 2 specimens; off Ziyogasaki, Aug. 11, 1926, 1 specimen; off Namiuchi, July 25, 1925, 4 specimens.

3) **Luidia yesoensis** Goto.

Luidia yesoensis : Goto, 1914, p. 306, pl. 5, fig. 89–90, pl. 6, fig. 91–94.

The species differs from *L. quinaria* in its rapidly tapering short arms, greyish rather than brown colour, and the dark radial band of the arm being not so distinct as in *Luidia quinaria ;* in young individuals the radial band could not be seen. The arms are shorter than in *Luidia quinaria,* but since the young of the latter have relatively shorter arms, it is rather difficult to distinguish the two species.

Loc. Between Kusōdomari and Bentenzima, Aug. 9, 1926, 6 specimens of various sizes.

Order SPINULOSA.

Family **Asterinidae.**

4) **Patiria pectinifera** (Müller & Troschel).

Patiria pectinifera : Fisher, 1919. p. 410.
Asteriscus pectinifera : Müller & Troschel, 1842, p. 40.
Asterina pectinifera : Goto, 1914, p. 634, pl. 18, fig. 272, 273; pl. 19, fig. 274.

[1]suna=sand; hitodé=starfish.

Many specimens from near the Marine Biological Station at Asamushi were examined. They were variable in colour; dark blue with cinnabar red patterns or cobald blue with cinnabar red patterns. The species is common on the coasts of Japan and is especially abundant in northern Honshu and Hokkaido. Goto (1914) describes the starfish in detail. Verrill (1913) divided *Asterina* into nine genera and afterwards Fisher (1919) reduced them to four, *Asterina, Patiria, Patiriella* and *Asterinopsis ;* and the species is named here *Patiria pectinifera* (Müller & Troschel), following his nomenclature.

Japanese name : Itomaki-hitodé.[1]

Family **Echinasteridae.**

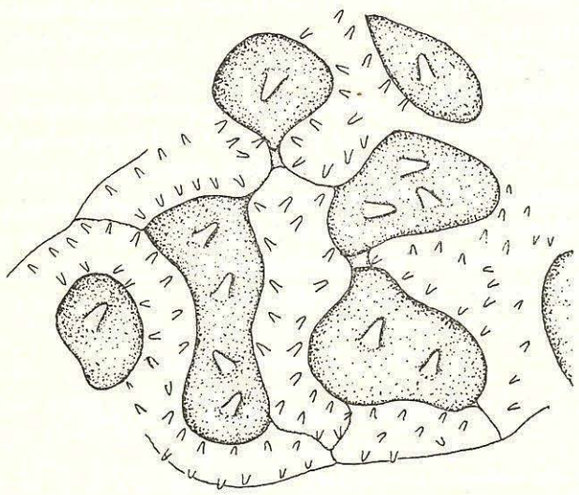
5) **Henricia sanguinolenta** (Müller).

(Pl. XXXII, fig. 8, 9.)

Henricia sanguinolenta : Fisher, 1911, p. 271, pl. 65, fig. 1, 2; pl. 66, fig. 1–5; pl. 68, fig. 3. — Verrill, 1914, p. 226, pl. 49, fig. 1–1 a, 2; pl. 88, fig. 3, 3 a, 4, 4 a.

Four specimens were examined; measurements as follows: R= 40 mm. and r=9 mm. (No. 1), R=29 mm. and r=7 mm. (No. 2), R=27 mm. and r=8 mm. (No. 3), and R=27 mm. and r=7 mm. (No. 4). Rays moderately long and generally tapering to the upwardly recurved extremity. Plates of abactinal surface forming an open network, with fairely large, irregular, deeply sunken papular areas of variable size, each with 1–4 papulae, and covered with groups of minute, delicate, terete, slender spines more or less arranged in single or double rows. Furrow spines short and directed somewhat abactinally. Adambulacral plates of the proximal portion of the ray each with 5 terete spines arranged in two alternate rows, with the largest near the furrow; those of the distal portion with 4 or 5 spines arranged in one transverse row, with the largest near the furrow as usual. Peractinal plates. transversely elongate, with 5 or 6 short clavate, rough-headed spines arranged in a transverse row. The two marginal plates are also transversely elongate, with single or double transverse rows of small spines. Two small specimens (No. 3 and No. 4), probably young of this species, have more slender adambulacral spines arranged in one transverse row even in the proximal por-

[1]itomaki=a Japanese spool; hitodé=starfish.



Text-fig. 1. *Henricia sanguinolenta;* a. abactinal surface of disc, b, peractinal spines (ps) and adambulacral spines (as). All ×10.

tion. Madreporite conspicuous, with rays. I could not determine the subspecies, because individual variations are so complicated and the subspecies are so difficult to distinguish owing to the existence of intermediate forms. But the specimens before me seem to belong mostly to *H. sanguinolenta* var. D of FISHER (1911).

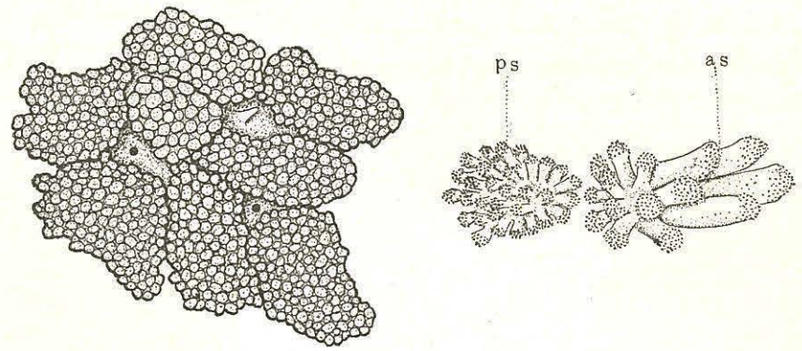
Loc. Off Noheji, August 22, 1926, No. 1; off Kawabazawa, Higashitsugarugori, August 22, 1926, No. 2; off Tsubakiyama, Higashitazawamura, Aug. 2, 1926, No. 3 & No. 4.

Döderlein (1902) recorded this species from Tokyo Bay, Sagami Bay and Bingo.

6) **Henricia leviuscula** (STIMPSON).

H. leviuscula: FISHER, 1910, p. 570; 1911, p. 280, pl. 69. fig. 1, 2; pl. 70, fig. 1, 2; pl. 71, fig. 2, 3; pl. 111, fig. 6. — VERRILL, 1914, p. 215, pl. 12, fig. 5, 6: pl. 13, fig. 1, 2; pl. 88, fig. 1, 1 a, 2–2 c.

The single specimen examined by me measured R=55 mm. and r=11 mm. Rays rather long and gradually tapering. Abactinal ossicles thick and closely united into a fine-meshed network with deep, very small papular areas, each with a papula. These ossicles are



Text-fig. 2. *Henricia leviuscula;* a. abactinal surface of disc, b. peractinal spines (ps) and adambulacral spines (as). All × about 8.

roundly convex, generally round and elliptical, though sometimes irregular, and their surface is densely covered with numerous round pseudopaxillae with minute spinules. Within the actinal furrow there is a very short spine. Adambulacral ossicle with double or triple transverse groups of 15–18 unequal spines, the larger ones near the furrow and the largest on the margin of the furrow. Peractinal and two marginal ossicles regularly arranged, nearly parallel to the furrow, the peractinal ones slightly smaller and the inframarginal slightly larger than the others; with short, clavate spines with spinulous head. Besides these four rows of ossicles, there is a small radial row between the peractinals and inframarginals and an interradial small, narrow, rhombic group of ossicles in 1–5 rows. Madreporite spinulose, with rays.

Loc. Off Ozawa, on the straight line between Benten and Kurosaki, Shimokitagori. Aug. 9, 1926.

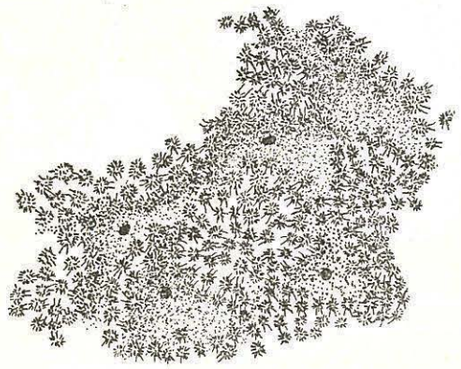
The species occurs on the Pacific coasts of America to Alaska and the Aleutians, but is recorded from Japan for the first time.

7) **Henricia leviuscula** var. **inequalis** VERRILL.

(Pl. XXXII, fig. 4, 5).

Henricia leviuscula var. *inequalis*: VERRILL, 1914, p. 219, pl. 88, fig. 1–1 a.

R=35 mm. r=8. Rays slender, moderately tapering, with recurved extremities. Abactinal plates very intricate, of various sizes, with numerous short, clavate, rough-tipped spinules. Papular areas deep and small. Furrow spines, one on each adambulacral plate, short and



Text-fig. 3. *Henricia leviuscula* var. *inequalis*; abactinal surface of disc. ×20.

laterally flattened. Adambulacral spines very large, 8–10, terete, rough-tipped, more or less in two rows, though irregularly directed, forming an elevated strip along the furrow margin. Peractinal plates each with about 15 terete, rough-tipped spines smaller than the adambulacral ones, facing the margin, though somewhat radially arranged. The two marginal plates bear spines similar to those of the peractinal, the inframarginal spines being larger than the supramarginal. Colour white in alcoholic specimen.

Loc. Nishihirauchimura, between Moura and Futagojima. July 21, 1926. 1 specimen.

The specimen agrees with the description and figures (pl. 88, fig. 1–1 a) given by VERRILL (1914), which are based on specimens from Queen Charlotte Islands, Victoria and Sitka, hence the identification.

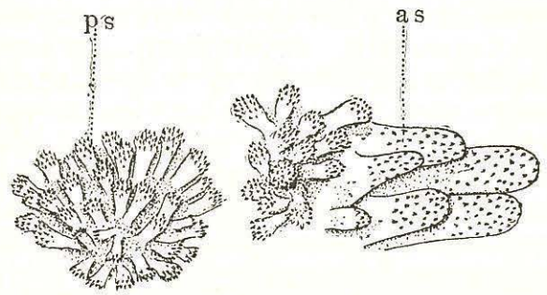
8) **Henricia leviuscula** var. **multispina.** FISHER.

(Pl. XXXII, fig. 2. 3).

Henricia leviuscula var. *multispina*: VERRILL, 1914, p. 222.

Henricia leviuscula multispina: FISHER, 1910, p. 571. — 1911. p. 286, pl. 72, fig. 1–4; pl. 73, fig. 1, 2.

Two specimens were examined, measuring R=25 mm, r=5 mm. and R=18 mm, r=4.5 mm. respectively. Rays moderately slender. Abactinal ossicles generally round or elliptical and rarely crescentic, bearing 15–40 thickly set, slender spinulate spines of equal length; one or two papulae in each area. Furrow spines one on each plate, pointed and recurved. Adambulacral spines are divided into two groups: the inner one consisting of larger spines arranged in 2–3, somewhat parallel horizontal series, with the larger ones near the



Text-fig. 4. *Henricia levinscula* var. *multispina*: peractinal spines (ps) and adambulacral spines (as). ×20.

furrow and the outer one of about 15 smaller spines arranged in about 3 longitudinal rows. These adambulacral and peractinal spines are larger than the inframarginal and supramarginal ones, which are slender and thickly grouped like the abactinal ones. There is a papular area between the inframarginal and supramarginal ossicles but none between the peractinal and inframarginal ones. Madreporite not easily distinguishable by the naked eye. The two specimens are probably young.

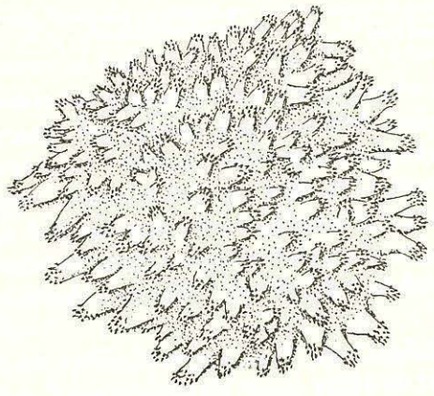
Loc. Yunoshima, Urata. Date uncertain.

FISHER (1910 & 1911) gives the distribution as from Oregon to Simushir, Kurile Islands.

9) **Henricia leviuscula** var. **nipponica,** n. var.

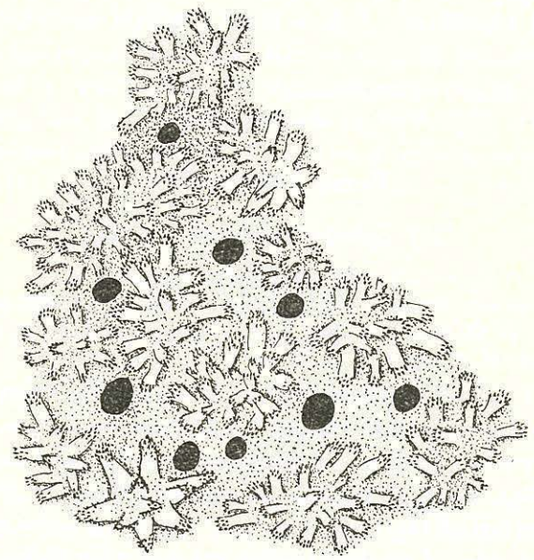
(Pl. XXXII, fig. 6, 7).

Many specimens were examined. R=11—20 mm, r=4—6 mm. Rays rather short, broad and recurved aborally at the extremity. Ossicles of the abactinal surface convex outwards, unequal, rounded, elliptical, lunate or of other irregular forms, forming an intricate network. Papular areas, comparatively small, irregular, deep, each generally with a single papula. These ossicles are covered by groups of cylindrical spines (generally 10–20) each with a minutely spinulose tip, which are shorter and thicker in the disc than in the rays. Madreporite situated in an interradius easily distinguishable by having comparatively large spines. The adambulacral, peractinal and two marginal ossicles are distinct and regularly arranged. Adambulacrals with double, alternate transverse series of 7–9 unequal spinulate spines, with the larger ones near the furrow. Within the furrow, there are short horizontal spines alternating with the tube feet. Peractinal ossicles opposite the adambulacrals with 6–8 spinulose spines which are more slender than those of the adambulacrals. Inframarginal ossicles with 8–18 slender spines just like those of the peractinals and arranged in two transverse rows. Supramarginal a little narrower than the inframarginals and similarly arranged. There are two rows of papular areas, each containing a papula, one between the peractinals and



Text-fig. 5. *Henricia leviuscula* var. *nipponica;* madreporite. ×20.

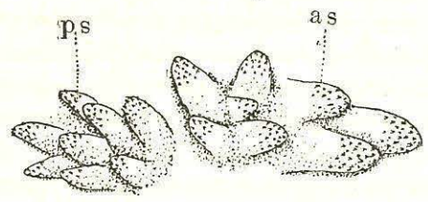
inframarginals, and the other between the inframarginals and supramarginals. Peroral spines four, in two radial rows, with a rounded head



Text-fig. 6. *Henricia leviuscula* var. *nipponica;* abactinal surface of disc. ×20.

and larger than any other spines.

This variety is easily distinguishable by its rather short rays and



Text-fig. 7. *Henricia leviuscula* var. *nipponica;* peractinal spines(ps) and adambulacral spines (as). ×20.

small size; it resembles somewhat the preceding variety (*multispina*) but is easily distinguished by its shorter arms, shorter abactinal spines and alternate arrangement of the adambulacral spines. It is very

common in the crevice of rocks near the tidal line about the Marine Biological Station and Yunoshima. Abactinal surface carmine red, with white papulae. The variety is also common at Oshoro and is there called *himéhitodé*. A form found at Misaki seems to be referable to this varity.

Japanese name : Hime-hitodé.[1]

Family **Solasteridae.**

10) **Solaster dawsoni** VERRILL.

(Pl. XXXII, fig. 1).

Solaster dawsoni : VERRILL, 1880, p. 193. — FISHER, 1911, p. 313, pl. 84, fig. 1-2; pl. 85, fig. 12; pl. 86, fig. 1-2; pl. 113, fig. 1. — VERRILL, 1914, p. 249, pl. 46, fig. 5-5 b; pl. 90, fig. 1; pl. 91, fig. 1, 2; pl. 92, fig. 1.

Rays 11 in two specimens collected in the Bay, short and rather rapidly tapering; disc fairly large. R=125 mm, r=40 mm. Abactinal surface covered by numerous, large, comparatively well spaced, tabulate pseudopaxillae, round or elliptical in contour; those of the disc and proximal portion of the rays larger and irregularly arranged, those at the end and sides of the rays smaller and somewhat radially arranged. Spinules on the pseudopaxilla variable in number (generally 20–50) and subequal in size, except the 1–3 larger ones generally situated in the central portion of some tabulate pseudopaxillae. Papulae numerous, 5–15 in each papular area but gradually decreasing in number toward the distal and lateral portion of the rays. Madreporic body conspicuous, situated midway between margin and center, with irregular striae. Supramarginals opposite inferomarginals in the proximal portion, but alternate in the distal, smaller, with 20 or more spinules; inframarginals transversely oblong and with 50–60 or more spinules. Adambulacral spines long, broad, blunt, nearly straight and arranged in transverse series of 4–5 each. Furrow spines slightly narrower than the adambulacral and arranged in longitudinal groups of 3 each. Oral spines 7–9, larger than the furrow spines. Actinal interradial areas small and containing more than 20 ossicles, each bearing 5–20 spinules. Tube feet with a well developed sucking disc, arranged in two series.

[1] himé=pretty; hitodé=starfish.

Mouth with leathery preoral portion. Colour reddish brown in alcohol.

Loc. 500 m. of the coast of Kusōdomari. Aug. 9, 1926. 2 specimens. I found a specimen of this species in the collection of Mr. B. HIKITA from Oshoro.

The species occurs from the Kuriles through the Aleutians to California, and is closely allied to *S. paxillatus* found in Yokohama and the Bering Sea but is distinguishable by its straight adambulacral spines and opposite arrangement of the two marginals, as pointed out by FISHER (1911).

Order FORCIPULOSA.

Family **Asteriidae.**

11) **Asterias rollestoni** BELL.

(Pl. XXXI, fig. 2, 3).

Asterias rollestoni : DÖDERLEIN, 1902, p. 333.

A large number of specimens in various stages were examined. In the smallest one R=2 mm. and r=1 mm., the abactinal interradial spines was only 3, and on either side of the median well spaced row of about 10 spines there were in the distal half of the ray about 5 spines arranged in a row. In the largest specimen R>100 mm. and r>40 mm., the spines were numerous and arranged in several radial rows. With growth, the arms become relatively longer and more rapidly tapering near the distal portion, but the abactinal spines remain comparatively small and well spaced even in full-grown specimens (R=33 mm, r=20 mm.). Abactinal surface purple with yellowish spines and pedicellariae. Actinal surface brownish yellow. It seems to me that the species can be distinguished from *A. versicolor*, a closely allied specimen, by attaining a larger size, the presence of three, more or less distinct rows of spines and rapidly tapering rays, though difficult to distinguish when young.

Japanese name : Hitodé.

Loc. Very common between Yunoshima and the Marine Biological Station. The species is also very common on the Pacific coasts of Japan and occurs also at Oshoro, Hokkaido.

12) **Asterias nipon** Döderlein.

(Pl. XXXIII, fig. 3, 4).

Asterias nipon : Döderlein, 1902, p. 334.

Specimen A : R=170 mm., r=28 mm., width of the arm base =30 mm.

Specimen B : nearly same as A.

Specimen C : R=220 mm., r=40 mm., width of the arm base =40 mm.

Arms long and gradually tapering ; disc relatively small. Abactinal plates in 7–9 radial rows, alternately small and large, each with a conical spine (in specimen A the spines were often bifurcated once or more) surrounded by a cluster of pedicellariae. Except the median row composed of closely arranged plates, these radial rows are not distinct. Disc and arms same in structure. Madreporite round in young specimens (A and B) but somewhat squarish in C. Supramarginals closely arranged, almost quadrate in shape, each with a sharp spine surrounded by a cluster of pedicellaria. Inframarginals opposite supramarginals, each with two blunt or occasionally flattened spines longer than those of the supramarginals and each with a cluster of pedicellaria on the abactinal base ; the plates show a few indistinct furrows towards the furrow plates and on their actinal surface another cluster of black large pedicellariae. Adambulacrals with two slender spines slightly shorter than the inframarginal and directed in various ways. Tube feet in 4–5 series, each with a well developed sucker. Abactinal surface black, spines and pedicellariae white. Actinal plates generally white but slightly purple in the young.

Loc. Off Futatsuyamura, Sept. 31, 1926 (Specimen A) Off Yasui-saki and between Moura and Futagoshima, Aug. 2, 1926. (Specimens B and C).

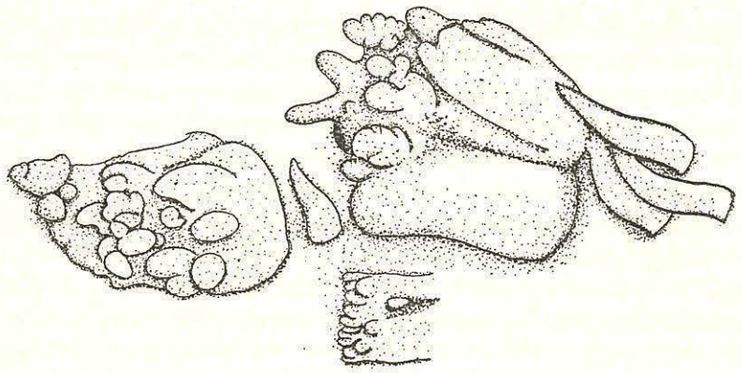
This species was described for the first time by Döderlein (1902) on the basis of a single specimen from the northern part of Honshu. Recently I found a fair number of specimens also in the collection of the Imperial Fishery Institute from the Pacific coast of northern Honshu.

13) **Aphelasterias japonica** (Bell).

(Pl. XXXI, fig. 4; Pl. XXXII, fig. 10).

Aphelasterias japonica : Fisher, 1923, p. 602.
Asterias japonica : Döderlein, 1902, p. 335.
Asterias torquata : Sladen, 1889, p. 570.

R=11 mm., r=3 mm. ; R=15 mm., r=4.2 mm. ; R=15 mm., r=4.3 mm. ; R=52 mm., r=10 mm. Rays five, broad and stout, tapering gradually in the basal but rapidly in the distal portion, constricted at base and easily breaking in preserved and moribund specimens. Disc



Text-fig. 8 *Aphelasterias japonica ;* spines with pedicellariae, and papulae on abactinal surface of ray. ×20.

relatively small. Abactinal plates with a few blunt spinulose spines, each, surrounded by small forcifiform pedicellariae, in 7–13 indistinct radial rows, of which the median one only conspicuous. Large, conical papulae between the spines. Madreporite round. Each supramarginal with 2–3 robust spines slightly longer than the abactinal ones. Each inframarginal with many transverse groups of 3–4 rough-tipped spines broader and longer than the supramarginal. These marginal plates provided with a cluster of pedicellariae. Adambulacral spines slender, nearly equal in length to the inframarginal, in a transverse pair and without pedicellariae. Tube feet in four series. The colour, though variable, is generally reddish brown with dark spots on abactinal sides ; pale brown on actinal side.

Japanese name : Ezo-hitodé.[1]

[1] Ezo= old name for Hokkaido; hitodé=starfish.

Loc. Off Jogasaki, Shimokitagori. Aug. 11, 1926. 1 specimen.
Off Ozawa. Aug. 9, 1926. 2 specimens.
Ōshima. July 16, 1926. 1 specimen.
The starfish is known at Oshoro as *Ezo-hitodè*.

The species has been recorded by SLADEN (1889) from Yokohama (at 5–25 fathoms) and by DÖDERLEIN (1902) from Tokyo Bay. It is probably a rather deep water form. In regard to the abactinal spines, SLADEN says, "The abactinal area is beset with plates which bear single, isolated, short, robust spinelets, very slightly tapering and obtusely rounded at the tip," and DÖDERLEIN says, "Dorsalplatten mit einzeln stehenden, ähnlichen, aber noch kleineren Stacheln, die in eine Carinalreihe und jederseits etwa 7–8 unregelmässige Längsreihen angeordnet sind". In our specimens the abactinal plates are provided with several blunt spines with pedicellariae and appear like a group of a few spinules; in other points, however, they agree with SLADEN's figures and descriptions.

Family **Pedicellasteridae.**

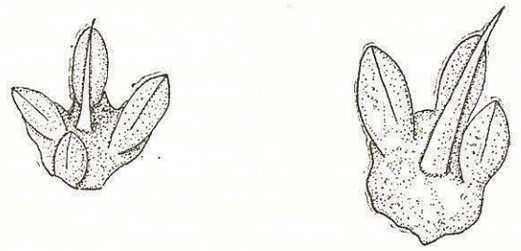
14) **Labidiaster borealis,** n. sp.

(Pl. XXXIII, fig. 1, 2).

Several specimens; the number of rays and measurements of three are given in the following table.

Diameter of disc		Length of the longest arm	Number of arm
A	11 mm.	25 mm.	22
B	15 mm.	40 mm.	23(+2 small ones)
C	26 mm.	82 mm.	35

Rays variable in length, especially in young specimens; new ones seem to develop from the abactinal side of the disc margin; they are long, cylindrical, flexible, constricted at the base, then gradually thicker, being widest at about 1/3 from base, beyond which they taper to the end; indistinctly forming two alternate rows in the adult. Disc small,



Text-fig. 9. *Labidiaster borealis*, n. sp.; abactinal spines surrounded by pedicellariae. ×20.

round, delicate and membranaceous, elevated about the base of the rays; the abactinal surface is formed by a network of many small imbricating plates bearing many slender uniform spines with forcipulate pedicellariae at the base and large triangular pedicellariae here and there. Madreporite round and situated midway between the center and margin of the disc. The abactinal surface of the rays is similar in structure to that of the disc, but the spines are sharp and slightly larger than those of the disc and not distinctly arranged in many transverse annuli, as in *Labidiaster annulatus*. Each supramarginal plate with a spine a little larger than an abactinal spine and surrounded by 1–3 forcipulate pedicellariae. Each inframarginal with a spine larger than any abactinal spine and with one or two large pedicellariae at the base. Adambulacral plates without pedicellaria but with two sharply pointed and similar spines slightly larger than the inframarginal. Tube feet closely arranged in two series. Mouth large, 18 mm in the largest specimen, surrounded by stout oral spines. Buccal membrane thick, leathery, with numerous radiating lines of small papillae. Reddish in alcoholic specimens.

Loc. Off Tsubakiyama, Higashitazawamura. Aug. 2, 1926. Off Kawauchi, on the line between Benten and Kurosaki. Aug 11, 1926. 5 specimens.
Off Tozawa. Aug. 11, 1926. 1 specimen.

Remarks. Two specis of *Labidiaster* are known, *L. annulatus* from near the Kerguelen and Heard Island (Southern Sea) and *L. radiosus* from the neighbourhood of the Strait of Magellan (both in the Atlantic and Pacific). The Japanese species differs from *radiosus* in the rather

smaller size of the disc spines as compared with those of the rays (in *radiosus* the spines are larger on the disc than on the rays). Again, in *L. annulatus* the spines are arranged in many transverse annuli in the rays and there is a pedicellaria at the base of each adambulacral spine, but in the new species the latter pedicellaria is absent and spines of the rays are arranged irregularly.

EXPLANATION OF PLATES.

Pl. XXXI.

Fig. 1. *Henricia leviuscula* var. *nipponica*, n. var.; abactinal side of a 6 rayed abnormal specimen, natural size.
Fig. 2. *Asterias rollestoni;* abactinal side, natural size.
Fig. 3. *Asterias rollestoni;* abactinal side of young specimen, natural size.
Fig. 4. *Aphelasterias japonica;* abactinal side, natural size.

Pl. XXXII.

Fig. 1. *Solaster dawsoni:* abactinal side ×2/3.
Fig. 2–3. *Henricia leviuscula* var. *multispina;* 2. abactinal side, 3. actinal side ×3/4.
Fig. 4–5. *Henricia leviuscula* var. *inequalis;* 4. abactinal side, 5. actinal side ×3/4.
Fig. 6–7. *Henricia leviuscula* var. *nipponica*, n. var.; 6. abactinal side, 7. actinal side ×3/4.
Fig. 8–9. *Henricia sanguinolenta;* 8. abactinal side, 7. actinal side ×3/4.
Fig. 10. *Aphelasterias japonica;* abactinal side 3/4.

Pl. XXXIII.

Fig. 1–2. *Labidiaster borealis* n. sp.; young specimen, 1. abactinal side, 2. actinal side ×3/4.
Fig. 3–4. *Asterias nipon;* 3. abactinal side, 4. actinal side ×2/3.

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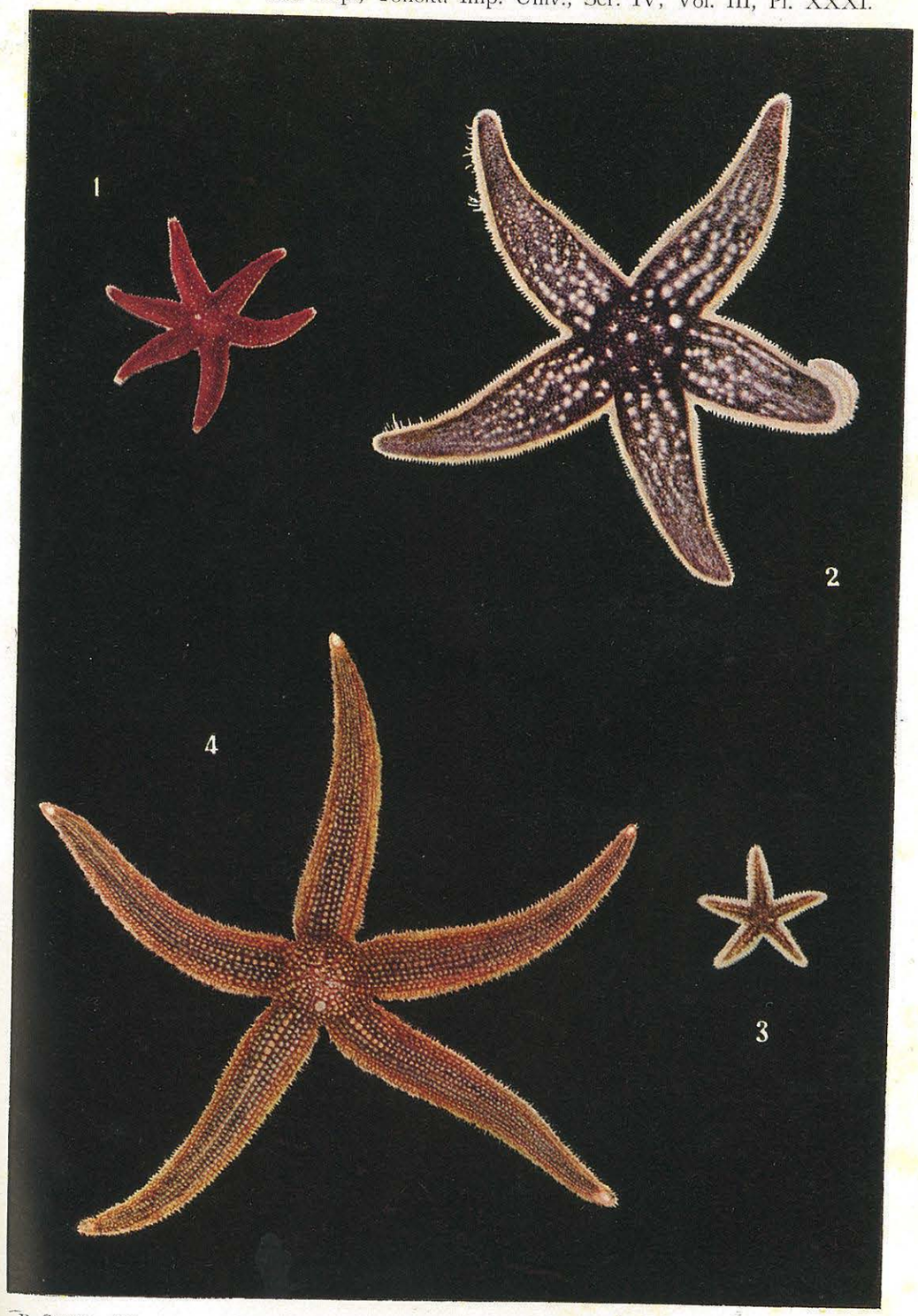
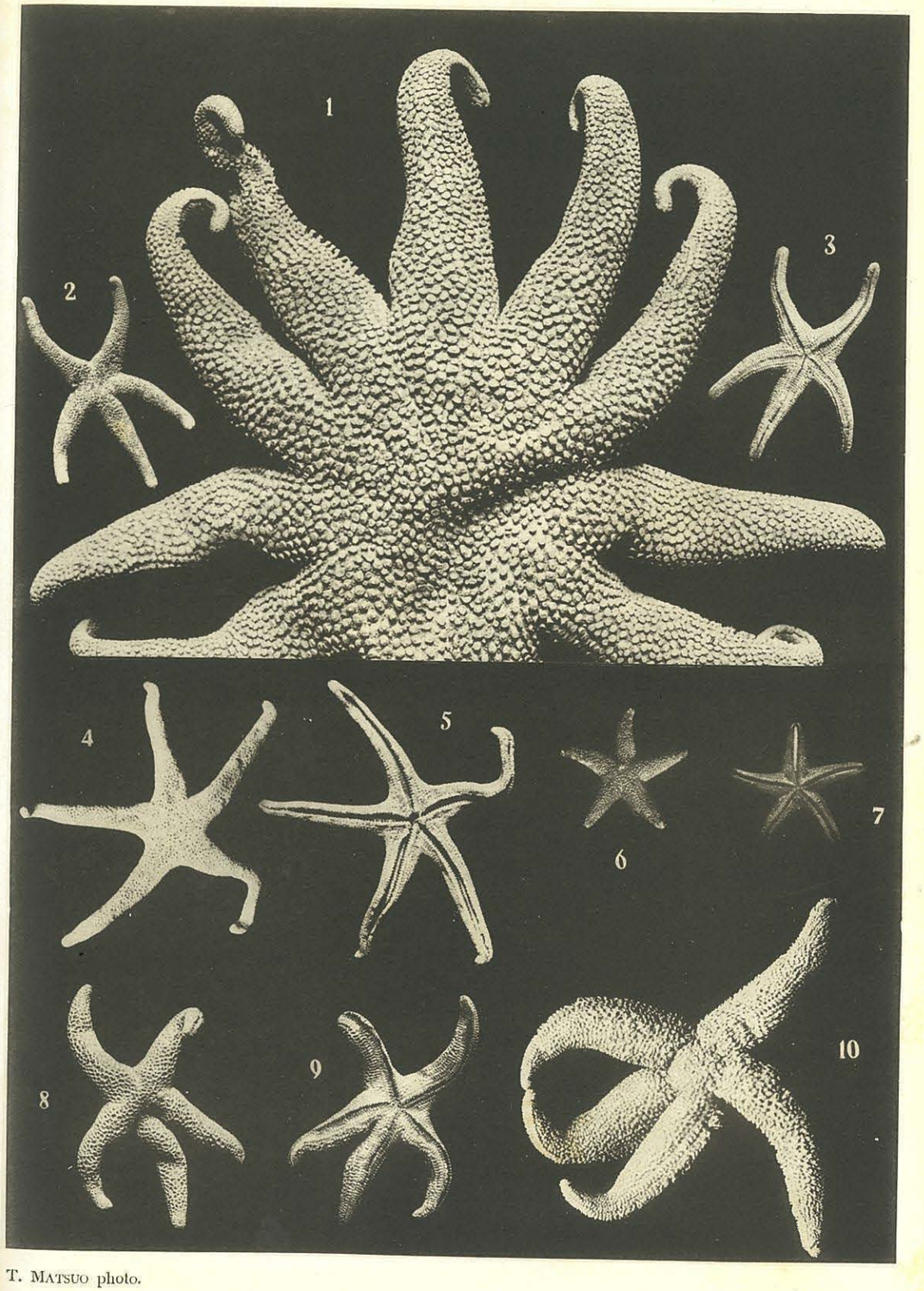


B. Sakuma del.



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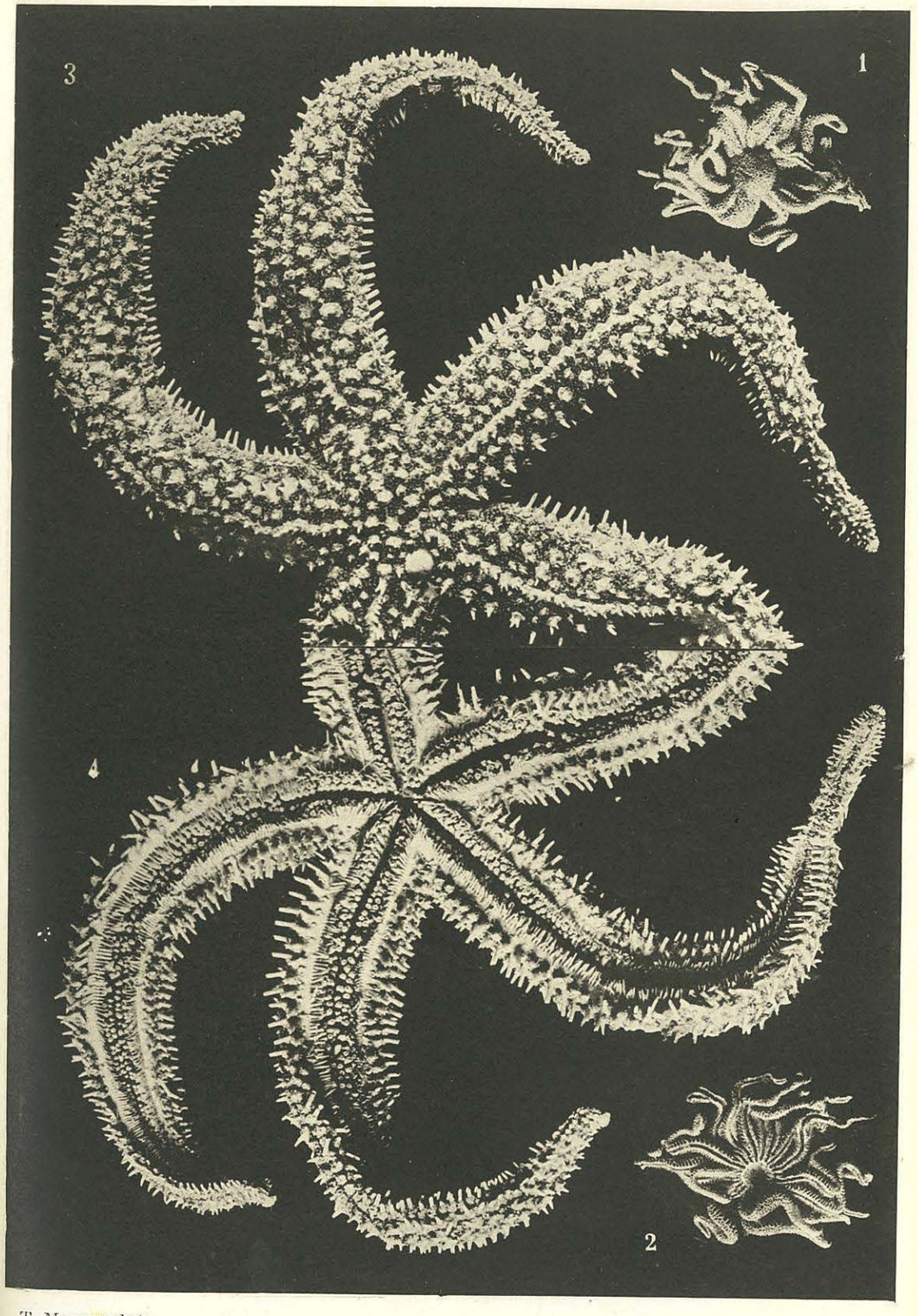

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